Bats (*Corynorhinus townsendii, Antrozous pallidus, Myotis thysanodes*)

Affected Environment

Population Status

Three of the 17 bat species occurring on Plumas National Forest (PNF) are designated as Forest Service sensitive species (*Antrozous pallidus, Corynorhinus townsendii, Myotis thysanodes*) and five are listed as species of special concern by the California Department of Fish and Wildlife (*A. pallidus, C. townsendii, Euderma maculatum, Lasiurus blossevillii, Eumops perotis californicus*; Table Z). Townsend's big-eared bat (*Corynorhinus townsendii*) populations have declined over the last 40-60 years in California (USDA 2001). Pallid bats (*Antrozous pallidus*) are of conservation concern because of sensitivity to disturbance, and abandonment of roosting sites (Arroyo-Cabrales and Grammont 2008). Fringed myotis (*Myotis thysanodes*) is distributed across California except the central valley and in deserts (Mayer and Laudenslayer 1988), and may be locally abundant or rare throughout western North America from British 0Columbia south to Mexico (Keinath 2004). Population dynamics are not understood, but limited data suggests serious population declines with many historically occupied sites abandoned because of disturbance and habitat modification (CBWG 2016).

Habitat Requirements

Forest structure is an important determinant of insectivorous bat assemblages (Blakey et al 2017), as bats have diverse morphological and call adaptations for a range of forests from cluttered to open in structure (Figure X; Schnitzler et al 2003; Blakey et al 2017, 2019b). For example, a large-bodied bat with narrow (high aspect ratio) wings and a long duration, low frequency call is well adapted to forage on fast prey in open spaces, but has difficulty maneuvering and detecting prey in cluttered habitat (Denzinger and Schnitzel 2013). In contrast, clutter-adapted bats can differentiate prey from surrounding vegetation using high frequency, wide bandwidth calls and maneuver well in small spaces with low aspect ratio wings.

All three sensitive bat species occurring on PNF exhibit morphological and call adaptation for cluttered environments (*M. thysanodes*: O'Farrell and Studier 1980, Schnitzler et al 2003; *A. pallidus*: Frick et al 2009; *C. townsendii*: Fellers and Pierson 2002, Segura-Trujillo et al 2016). These three species exhibit a continuum of roost site requirements. *C. townsendii* is colonial and roosts in caves, mines, and abandoned human structures, similarly *M. thysanodes* and *A. pallidus* roost in caves, crevices, and mines but these species also utilize live trees and snags for roosting.
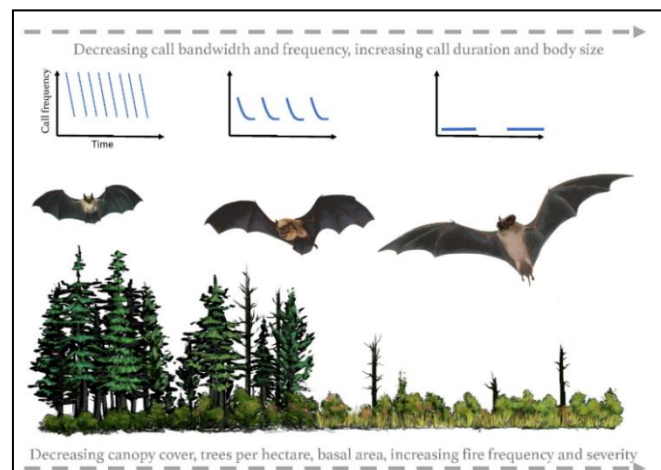

Figure X. Illustration of ecomorphological relationships in Plumas National Forest bat community. As habitats change across a gradient of increasing burn severity and frequency and decreasing clutter (left to right), larger bats with narrower bandwidth, lower frequency and longer duration calls are more likely to occupy the area. From left to right, representatives from three bat foraging strategies are shown: clutter-adapted (*Myotis thysanodes*), edge-adapted (*Eptesicus fuscus*) and open-adapted (*Tadarida brasiliensis*). Body sizes are not to scale (after Blakey et al 2019b). Illustrations by Lauren Helton.

Existing Condition and Proposed Treatment

The Mooreville Ridge Insect and Disease Resilience Project (Mooreville Project) will undertake mechanical thinning operations on the Feather River Ranger District (FRRD), Butte and Plumas Counties. The area is located west and southwest of La Port and approximately 20 miles northeast of Challenge CA. (Figure 1: T20N, R8E, S4-7; T21N, R8E, S1,12,15, 21,22, 27-29, 32, 33; T21N, R9E S5-8,17-20; T20N, R7E S1,12; T20N R8E S4-7; T22N, R9E S31 USGS 7.5 minute topographic quadrangle maps: American House Strawberry, Valley Clipper Mills, and La Porte). Elevation in the project area ranges between 3,700 and 5,900 feet. Annual precipitation ranges between 70-90 inches. Most of the area is comprised of Sierra mixed conifer forest (*Abies concolor, Pseudotsuga menziesii, Pinus ponderosa, Pinus lambertiana, Calocedrus decurrens, Abies magnifica, Quercus kelloggii, Arbutus menziesii*).

The Mooreville Project bat analysis area (41,476 acres) was delineated to encompass the project area as well as representative habitat surrounding the project area to provide a relative context on the landscape while evaluating potential direct, indirect and cumulative project impacts to bats and their habitat, including portions of Slate Creek, Little Grass Valley Reservoir-South Fork Feather River, Oroleve Creek-South Fork Feather River, Mill Creek-North Yuba River, Rock Creek-South Fork Feather River subwatersheds (Level 12, HUC 6, Figure Y). The Mooreville Project (3,030 acres) proposed to treat 2,091 acres with mechanical thinning and biomass removal (including timber extraction for sale) and 939 acres of service work (no timber extraction for sale: mastication, hand cutting and prescribed fire). Service work also may occur across the entire project area (3,030 acres) as necessary when implementing prescribed fire treatments. Mechanical thinning will occur in stands that are overstocked, have poor regeneration, have high fuel loading, and or displaying signs of disease. Thinning areas will be subject to biomass removal of trees ≤ 10" diameter at breast height (DBH) and grapple pile. Service work includes the removal of small ≤ 10" DBH size trees or brush by either masticating or hand cutting and prescribed fire. Targeted grazing with goats could be used as needed in areas where acceptable fire behavior conditions do not exist and cannot be achieved through conventional methods.
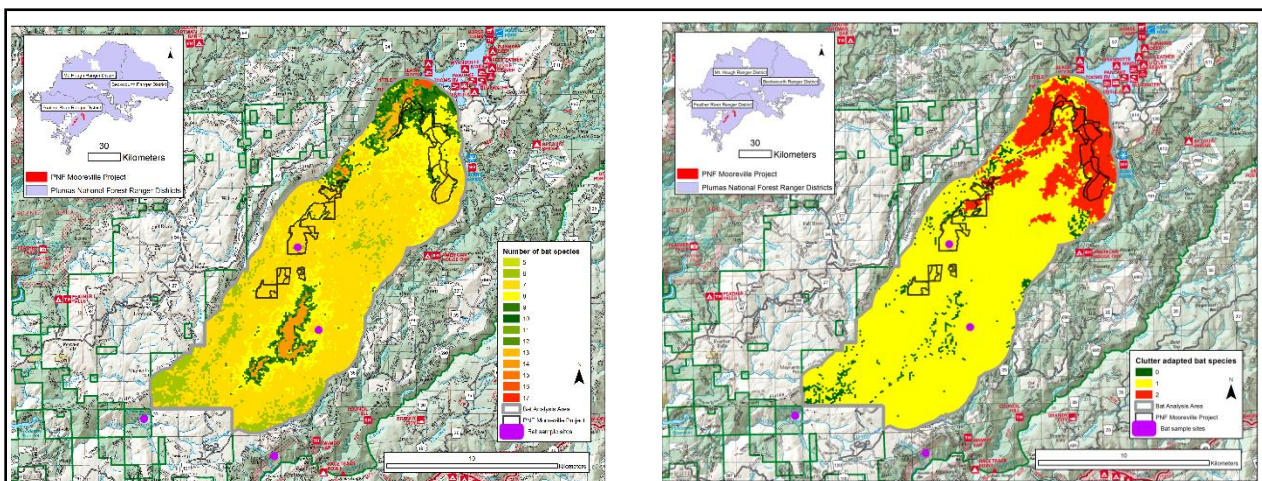

Figure Y. Mooreville Project area, bat analysis area, survey sites and predicted bat species richness (left panel) for the entire bat community, based on multi-species occupancy model results (4 physiographic variables, 2 forest structure variables and one fire variable; N=17 species; Blakey et al 2019a) and (right panel) for clutter-adapted species, based on separate occupancy models for each species (N=2 species; Blakey et al 2019b).

Table Z. Bat species detected in Plumas National Forest, with percentage of the 83 sample sites in which each species was recorded (%), total nights detected (n), and mean detection (ρ) and occupancy (ψ) probabilities for top-ranked models (modified after Blakey et al 2019b). Sparse detections for 8 species precluded modeling detection and occupancy probabilities. Call traits included characteristic call frequency (Fc), call bandwidth (BW) and call duration (Dur) and were obtained from summaries of western US bat call characteristics included in Sonobat (*SonoBat 4.2.2* , SonoBat, Arcata, CA, US), after Blakey et al (2019b).

Scientific name	Common name	Foraging strategy	%	n	ρ	ψ	Fc kHz	BW kHz	Dur ms	Mass g
Myotis californicus	California myotis	Edge	83	160	0.77 ± 0.03	0.92 ± 0.04	49.1	54.3	3.8	4.2
Myotis evotis	Western long-eared myotis	Clutter	74	114	0.58 ± 0.04	0.89 ± 0.05	34.3	50.4	3.7	7.3
Lasionycteris noctivagans	Silver-haired bat	Edge	53	92	0.67 ± 0.05	0.58 ± 0.07	26.5	16.1	9.2	10.6
Eptesicus fuscus	Big brown bat	Edge	42	66	0.55 ± 0.06	0.53 ± 0.01	28.2	29.4	7.8	15.9
Tadarida brasiliensis	Mexican free-tailed bat	Open	37	59	0.55 ± 0.17	0.43 ± 0.08	25.5	8.2	11.5	12.5
Lasiurus cinereus	Hoary bat	Open	29	32	0.27 ± 0.06	0.47 ± 0.12	20.1	6.3	11	33
Myotis lucifugus	Little brown bat	Edge	29	48	0.46 ± 0.08	0.29 ± 0.09	40.8	36.4	6	7.1
Myotis thysanodes	Fringed myotis[+]	Clutter	24	30	0.38 ± 0.08	0.26 ± 0.08	24.5	52.6	3.9	8.4
Myotis yumanensis	Yuma myotis	Edge	19	28	0.29 ± 0.08	0.25 ± 0.08	49.2	44.4	5.5	5.2
Antrozous pallidus	Pallid bat*[+]	Clutter	19	21	NA	NA	28	28.3	6.8	17.3
Myotis volans	Long-legged myotis	Edge	18	18	NA	NA	41.6	52.7	4.8	10.4
Lasiurus blossevillii	Western red bat*	Edge	10	13	NA	NA	38.9	15.8	10.7	12.5
Corynorhinus townsendii	Townsend's long-eared bat*[+]	Clutter	5	6	NA	NA	23.4	21.1	4.6	10.2
Myotis ciliolabrum	Small-footed myotis	Edge	4	5	NA	NA	44.3	54.5	3.2	4.9
Parastrellus hesperus	Canyon bat	Edge	5	5	NA	NA	45.9	15.2	5.5	4.4
Eumops perotis californicus	Western mastiff bat*	Open	2	3	NA	NA	10.4	10.4	15.4	53.5
Euderma maculatum	Spotted bat*	Clutter	2	2	NA	NA	10	4.9	3.2	17.9

* California Species of special Concern by California Department of Fish and Wildlife.

[+] USDA Forest Service, Pacific Southwest Region, 2013, Regional Forester's Sensitive Species (https://www.fs.usda.gov/detail/r5/plants-animals/wildlife

Blakey et al (2019b) sampled bats acoustically at 83 randomly selected sites (n = 249 recording nights) across the Plumas National Forest over three summers (2015-2017), investigating relationships between fire regime, physiographic variables and forest structure and probability of bat occupancy for nine frequently detected species (17 bat species detected on the forest in total, Table Z). Results indicated relationships between bat traits were underpinned by adaptations to diverse forest structure (Figure X, Table Z). Bats with traits adapting them to foraging in open habitats, including emitting longer duration and narrow bandwidth calls, were associated with higher severity and more frequent fires, whereas bats with traits consistent with clutter tolerance (structurally complex vegetation) were negatively associated with fire frequency and burn severity; relationships between edge-adapted bat species and fire were variable on the forest and may be influenced by prey preference or habitat configuration at a landscape scale (Blakey et al 2019b). All three Forest Service sensitive species (*A. pallidus* and *C. townsendii, M. thysanodes*) employ a clutter-adapted foraging strategy (i.e., utilizing structurally complex vegetation, Table Z, Figure X). Clutter-adapted bats can differentiate prey from surrounding vegetation using high frequency, wide bandwidth calls and maneuver well in small spaces with low aspect ratio wings; however, some of these attributes (e.g., slow flight speed) may result in clutter-adapted bats being relatively more susceptible to predation in open habitats (Sleep and Brigham 2003).

Two (*A. pallidus, C. townsendii*) of three Forest Service sensitive species were not sufficiently detected (detected < 10 % of nights) to allow modeling of occupancy and detection probabilities (Table Z, Blakey et al 2019b). The rarity of these species poses challenges to understanding their life histories and ecology, let alone managing for specific resource needs. However, M. thysanodes (sensitive species) and *Myotis evotis* (clutter-adapted species) were detected with sufficient frequency to model species occupancy across the forest (Table Z), and we used occupancy modeling results for these sympatric clutter-adapted bats to infer project impacts to foraging habitat of other clutter tolerant bats (e.g., *A. pallidus* and *C. townsendii*).

All nine species with sufficient detections (detected > 10 % of nights) to allow modeling of occupancy were predicted to occupy the analysis area and treatment units; however, *Myotis yumanensis* (edge-adapted species) was not predicted to occupy a large portion of either area (Table Y). Similar to *M. yumanensis*, two other edge-adapted species (*M. lucifugus, Eptesicus fuscus*) were not predicted to occupy a large portion of the analysis area or treatment units, but *Lasionycteris noctivagans* (edge-adapted species) was predicted to occupy 100% of the analysis area (Table Y). Occupancy of one clutter-adapted species (*M. thysanodes*) was predicted to be relatively high at the landscape and treatment unit scale; however, another species (*M. evotis*) was predicted to occur within a fifth of the analysis area but over half of project treatment acres (Table Y). *Lasiurus cinereus* (open-adapted species) was predicted to occupy a larger proportion of treatment units relative to the surrounding landscape (i.e., analysis area, Table Y). It should be noted that our predictive occupancy models did not target waterbodies and are likely to underestimate occupancy of bats where these features are present, particularly species that forage over water like *M. yumanensis*. Two sites within the analysis area and two sites adjacent to the analysis area were surveyed during 12 nights as part of occupancy modeling efforts. Five species (*M. yumanensis, M. californicus, M. evotis, M. thysanodes, Lasiurus cinereus*) were detected within the analysis area and six species (*M. yumanensis, M. californicus, M. evotis, Eptesicus fuscus, Lasionycteris noctivagans, Lasiurus cinereus*) were detected south of the analysis area (USDA Forest Service NRIS Wildlife, Natural Resource Manager, accessed March 8, 2019).

Table Y. Proportion of analysis area and Mooreville Project area predicted to be occupied by nine bat

Species*	Analysis area (41,476 acres)	Treatment units (3,030 acres)	Foraging strategy
Myotis yumanensis	7%	2%	Edge
Myotis californicus	99%	93%	Edge
Myotis lucifugus	3%	3%	Edge
Myotis evotis	20%	55%	Clutter
Eptesicus fuscus	4%	14%	Edge
Lasionycteris noctivagans	100%	100%	Edge
Myotis thysanodes*	93%	92%	Clutter
Tadarida brasiliensis	95%	99%	Open
Lasiurus cinereus	14%	22%	Open

*USDA Forest Service, Pacific Southwest Region, 2013, Regional Forester's Sensitive Species (https://www.fs.usda.gov/detail/r5/plants-animals/wildlife/

species (Blakey et al 2019 a,b).

Environmental Consequences

Proposed treatments would have short- and mid-term negative impacts (1-50 years post implementation) to sensitive bat species through reduction in complex forest vegetation structure, and project activities could disturb or cause abandonment of roost colonies if present. There are potential long-term benefits if proposed treatments should reduce the risk of future high severity wildfire passing through this landscape and potentially destroying all clutter-adapted sensitive habitat.

Direct, Indirect and Cumulative Effects of all Proposed Actions

Mechanical thinning (2,091 acres)

Service Work (939 acres)

Direct effects are possible through the destruction of active roosts through removal of trees with hollows or loose bark, especially snags. The use of heavy equipment and chainsaws may cause noise and vibration

disturbance significant enough to cause temporary or permanent abandonment of roost sites. These effects would be most severe during the breeding season (May 1 to August 15) when the potential exists for disturbance to active breeding females and maternity colonies. Proposed treatments would have short- and mid-term negative impacts (1-50 years post implementation) to sensitive bat species through reduction in complex forest vegetation structure, and potential long-term benefits if proposed treatments should reduce the risk of future high severity wildfire passing through this landscape and potentially destroying all clutter-adapted sensitive habitat. Proposed treatments also may result in clutter-adapted bats being relatively more susceptible to predation as it is reasonable to expect more open habitat will be created by proposed treatments (Sleep and Brigham 2003, Blakey et al 2019b). Aside from changes in habitat availability for clutter-adapted (sensitive) bats, prey availability also may be impacted by treatments and indirectly affect sensitive species foraging efficiency; however, the direction and level of potential impacts is unknown. Changes to foraging habitat via hand thinning are insignificant at the forest and species range scales. Managed fire may consume potential roost sites, but those same areas also would likely recruit potential roost sites through the prescribed burning process, so effects are expected to be negligible.

Cumulative Effects

The existing condition reflects changes on the landscape from all activities that have occurred in the past, and analysis of cumulative effects of the proposed action evaluates the impact of the project on the existing condition within the analysis area. Cumulative effects to sensitive bat species could occur with the potential incremental loss of quantity and/or quality of habitat. Personal firewood cutting is a permitted ongoing activity in the analysis area along National Forest System Roads, and may negatively impact roost site availability and quality, given the majority of bat species on the Plumas National Forest use trees (alive and/or dead) for roosting. Road improvements associated with project activities may result in increased personal firewood collecting in the analysis area due to improved accessibility and snag visibility; however, data is not gathered on firewood collecting to permit such an evaluation. Ongoing activities on this landscape, but outside the analysis area, are dominated by fuels reduction work and reintroduction of fire to the landscape which were designed to restore a resilient fire-adapted landscape. A future project (Devils Gap) is being planned in the vicinity of the Mooreville Project, but none of Devil;s Gap project will overlaps with the Mooreville Project. Implementation of Davil's Gap is projected to begin in 2020-2021. Devils Gap will be designed to remove tree mortality caused by bark beetles along roadsides. The Mooreville Project was designed to reduce fuel loading in the forest and return fire back to the ecosystem. The risk of cumulative effects from the proposed ongoing and future activities will likely be negligible at this time based on the relatively small size of the project area in relation to habitat availability.

Determination

The Mooreville Ridge Insect and Disease Resilience Project may directly and indirectly impact individual sensitive bats (*Corynorhinus townsendii, Antrozous pallidus, Myotis thysanodes*) through implementation disturbance, reduced roost site availability and suitability, and will have short- and mid-term negative impacts (1-50 years post implementation) on sensitive bat foraging habitat; however, the project is not likely to result in a loss of viability in the analysis area, nor cause a trend toward federal listing.

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